

WHAT IS CLAIMED IS:

1. An optical semiconductor apparatus constituting an optical signal transmitter-receiver of a bidirectional communication system employing a single-core fiber, comprising,

a surface-emitting semiconductor laser device and
a light-receiving device;

wherein the surface-emitting semiconductor laser device and the light-receiving device are disposed on a common substrate;

wherein the surface-emitting semiconductor laser device functions as a light signal transmitting device, has a columnar layered structure, and has a light emerging surface on the columnar layered structure;

wherein the light-receiving device functions as a light signal receiving device, has an annular layered structure around the surface-emitting semiconductor laser device with an isolation region interposed there between, and has the annular light-receiving surface and the columnar light-emerging surface lying at the same level;

wherein the diameter of the light-receiving device is smaller than that of an optical fiber core optically coupled with the optical semiconductor apparatus.

2. The optical semiconductor apparatus according to claim 1,

wherein a common electrode is disposed on the backside of the semiconductor substrate one electrode of the surface-emitting semiconductor laser device and one electrode of the light-receiving device,

wherein the other electrode of the surface-emitting semiconductor laser device is circularly disposed on the layered structure of the surface-emitting semiconductor laser device and is extracted by an extraction electrode extending over an insulating film disposed on the light-receiving device, and

wherein the other electrode of the light-receiving device is annularly disposed on the periphery of the light-receiving device.

3. The optical semiconductor apparatus according to claim 1, wherein the light-receiving device is capable of receiving a laser beam with an oscillation wave length of the surface-emitting semiconductor laser device.

4. An optical semiconductor apparatus constituting an optical signal transmitter-receiver of a bidirectional communication system employing a single-core optical fiber, comprising:

a light-receiving device; and

a surface-emitting semiconductor laser device;

wherein the light-receiving device functions as a light signal receiving device and a circular layered structure on a semiconductor substrate;

wherein the surface-emitting semiconductor laser device functions as a light-transmitting device, is disposed on the central region of the layered structure of the light-receiving device, and has a columnar layered structure with a diameter smaller than the diameter of the light-receiving device;

wherein the region on the layered structure of the light-receiving device excluding the region of the surface-emitting semiconductor laser device functions as a light-receiving surface; and

wherein the diameter of the light-receiving device is smaller than the optical fiber core optically coupled with the optical semiconductor apparatus.

5. The optical semiconductor apparatus according to claim 4,

wherein a first electrode of the light-receiving device is disposed on the backside of the semiconductor substrate and a second electrode is disposed on the periphery of the light-receiving surface on the layered structure of the

light-receiving device, and

wherein a first electrode of the surface-emitting semiconductor laser device is circularly disposed on the layered structure of the surface-emitting semiconductor laser device and a second electrode is disposed on the lowermost layer of the layered structure of the surface-emitting semiconductor laser device extending outwards from the layered structure of the surface-emitting semiconductor laser device on the layered structure of the light-receiving device.

6. The optical semiconductor apparatus according to claim 4, wherein the light-receiving device is capable of receiving a laser beam with an oscillation wave length of the surface-emitting semiconductor laser device.

7. An optical semiconductor apparatus constituting an optical signal transmitter-receiver of a bidirectional communication system employing a single-core optical fiber, comprising a surface-emitting semiconductor laser device and a light-receiving device,

wherein the surface-emitting semiconductor laser device functions as a light signal transmitting device and has a columnar layered structure disposed on a semiconductor substrate,

wherein the light-receiving device is disposed on the layered structure of the surface-emitting semiconductor laser device, and has a central opening for exposing the light-emerging surface on the layered structure of the surface-emitting semiconductor laser device, and

wherein the diameter of the light-receiving device is smaller than the diameter of the optical fiber core optically coupled with the optical semiconductor apparatus.

8. The optical semiconductor apparatus according to claim 7,

wherein a first electrode of the surface-emitting semiconductor laser device is disposed on the backside of the semiconductor substrate and a second electrode is circularly disposed on the exposed layered structure of the surface-emitting semiconductor laser device and is extracted by an extraction electrode extending over an insulating film disposed on the opening wall, and

wherein a first electrodes of the light-receiving device is disposed on the lower layer of the layered structure of the light-receiving device partially exposed on the layered structure of the surface-emitting semiconductor laser device and a second electrode disposed on the layered structure of the light-receiving device.

9. The optical semiconductor device according to claim 7, wherein the light-receiving device is capable of receiving a laser beam with an oscillation wave length of the surface-emitting semiconductor laser device.